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On the Relationship Between Speech and Writing With Implications for Behavioral Approaches to Teaching Literacy

Roy A. Moxley
West Virginia University

Two theories of the relationship between speech and writing are examined. One theory holds that writing is restricted to a one-way relationship with speech—a unidirectional influence from speech to writing. In this theory, writing is derived from speech and is simply a representation of speech. The other theory holds that additional, multidirectional influences are involved in the development of writing. The unidirectional theory focuses on correspondences between speech and writing while the multidirectional theory directs attention to the differences as well as the similarities between speech and writing. These theories have distinctive pedagogical implications. Although early behaviorism may be seen to have offered some support for the unidirectional theory, modern behavior analysis should be seen to support the multidirectional theory.

Two basic theories with variations have been posed for the relationship between speech and writing (Stotsky, 1987). Using two of Stotsky's descriptors, these two theories will be referred to as the unidirectional theory and the multidirectional theory although other terms have been offered, such as the recoding model and the interactive model (Moran, 1987). The unidirectional theory considers the relationship as a one-way sequence in which speech determines the development of writing. Writing is simply a way of preserving speech and may be referred to metaphorically as "frozen speech." This theory focuses on the correspondences between speech and writing. By contrast, in addition to regarding the influence of speech on writing and the correspondences between the two as significant, the multidirectional theory holds that writing also influences speech and that there are other important influences on the development of writing. This theory gives special consideration to the differences between speech and writing. Each theory also has important implications for educational practices in the teaching of literacy. Currently, a substantial amount of controversy surrounds some of these practices, whose advocates may appeal to one theory for support or the other for attack (see Adams, 1990; Carbo, 1988; Chall, 1989; Moxley, 1990).

The relationship of behavior analysis to these theories and their implied practices, however, may appear somewhat ambiguous in as much as there are grounds for associating behavioral positions in support of each theory. This has resulted in misstatements from some commentators on the behavior analytic position, and the reasons for these misstatements are often puzzling to behavior analysts. In order to more effectively address these misstatements and to clarify any misconceptions among behavior analysts themselves, some clarification of the relationship of behavior analysis with these theories seems in order. This clarification also reveals important practical implications for developing behavioral technologies in the teaching of literacy. The following coverage includes the areas of orality (speaking and listening) and literacy (writing and reading). Speaking will be considered both as a

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response (or a response product) and as a stimulus for a response (listening), just as writing will be considered as a response (or a response product) and as a stimulus for a response (reading). In as much as we "listen to speech" rather than "listen to speaking," the term speech will be used to keep considerations of speaking and listening in play.

THE UNIDIRECTIONAL THEORY

The unidirectional theory of the dependence of writing on speech has a long history. Plato expanded at length on the inferiority of writing to speech in his *Phaedrus*, and Aristotle (1938) maintained that "Words spoken are symbols or signs of affections or impressions of the soul; written words are the signs of words spoken" (p. 115). In the early part of this century, prominent linguists in Europe and America made more explicit claims that writing is not language and that its sole purpose is to represent speech:

> Language and writing are two distinct systems of signs; the second exists for the sole purpose of representing the first. (de Saussure, 1915/1966, p. 23)

> Written language is thus a point-to-point equivalence, to borrow a mathematical phrase, to its spoken counterpart. The written forms are secondary symbols of the spoken ones—symbols of symbols. (Sapir, 1921, p. 19)

These accounts do not allow for more than a derivative role for writing and formal, one-to-one relationships between speech and written responses to speech. As exemplified by the subtitle of *Phonemics: A Technique for Reducing Languages to Writing* (Pike, 1947), this derivative role for writing was furthered by anthropological field practices for transcribing speech sounds into writing. This role became virtually an implicit tenet with linguists who devoted their attention to speech (Householder, 1971). It was advanced, somewhat ironically, by using writing to analyze speech and using written forms as models for spoken forms.

In reading, some cognitive models have been consistent with the assumptions of unidirectional theory, using the correspondences from speech to writing to postulate a backward direction of such correspondences from writing codes to speech codes in reading: "Once a visual word code makes contact with the phonological word code in reading, we assume that the meaning of the word can be elicited by means of a direct associative connection between the phonological unit . . . and the semantic meaning unit" (LeBerge & Samuels, 1985, p. 703).

Note that the context of a written word does not enter into the association with meaning.

Educational Implications

One or more of the following educational practices can be inferred from the presentations of writers who advocate implementations of unidirectional theory (the order of implementation and the emphasis on any one practice varies with different advocates). (1) Schools should develop spontaneous speech, uninfluenced by writing, as preparation for literacy. (2) In producing writing, schools should teach students to transcribe dictated speech into writing, sometimes referred to as "encoding" (converting speech sounds into individual letters and letter combinations). In this way, students are presumably learning the correspondences from speech to writing. (3) In responding to writing, schools should teach students to read aloud through "decoding" with a phonics emphasis (converting individual written letters and letter combinations into speech sounds). Thereby, students presumably learn the correspondences from writing to speech. The original one-way directional correspondences from speech to writing are now traveled in reverse so to speak. (4) These practices should be sufficient for students to acquire literacy.

Although Moffett and Wagner (1983) recommended activities to develop spontaneous speech in the classroom, this first implication of the unidirectional theory is not a priority in the typical classroom. Prepared speech—speech that resembles or is based upon a written text—receives more explicit attention. Practices for the second implication (encoding or transcrip-

tion) are more prevalent. For example, the typical assessment of spelling is through the teacher's oral dictation without allowing students recourse to written references like dictionaries. The spelling of many words in English, however, cannot be predicted from their speech sounds. Orthographic rules like "i before e except after c" can be helpful; but these rules have so many exceptions that skilled spellers may be considered something of a marvel. In whatever way they became good spellers, it was by doing something other than simply translating the sounds of speech into print.

Practices for the third implication (decoding) are prominently advanced, often in ways that include the other implications as well. Moffett and Wagner (1983), for example, make a case for these practices within a hierarchical process, similar to Aristotle's soul-speech-writing sequence: experience is "encoded" into thought at the first level (conceptualization), thought is "encoded" into verbalization at the second level (verbalization), and speech is "encoded" into writing at the third level (literacy). At this third level, "People encode from oral speech to writing and decode from writing into oral speech. What is called literacy comprises these activities. This level is derivative, because it is an overlay of printed symbols upon vocal symbols" (p. 5).

According to Moffett and Wagner (1983), the basic skills cover both directions of the correspondences between speech and writing:

> What teachers commonly call "the basic skills" are the skills of transcribing speech into writing and of decoding writing into speech. The transcription skills are handwriting, spelling, and punctuating. The decoding skills include word recognition and word attack. . . . These "basic skills" are basic for literacy only, not for general discourse. All they do is annex to the prior, oral-aural medium the new, visual medium. The *true* basic skills are conceptualizing and verbalizing....This is not to minimize, however, the obvious difficulties that many children have learning to decode and transcribe. The point is that these difficulties can be greatly reduced by treating meaning as nothing less than what it is—the matching of thought with language. Meaning goes with the oral language, and as soon as a reader recognizes in the printed symbols the spoken words he already knows, he will get the meaning or at least whatever meaning the oral words have for him. (pp. 402-403)

Throughout, the task is a matching one—to establish one-to-one correspondences in moving from one hierarchical level or medium to another. The practices that produce this movement (the first three implications of unidirectional theory) should then be sufficient for literacy (the fourth implication of unidirectional theory).

Of interest because of its association with behavior analysis, an adaptation of the Distar reading program provides another description of decoding that supports unidirectional theory:

> Decoding—is the central skill in initial reading. Most of the other skills are nothing more than language skills. Once a sentence has been decoded, it is like a spoken sentence that may have been presented slowly. If the child has the language skills necessary to *understand* the spoken sentence, the child has the skills necessary to understand the decoded sentence. The central issue is not that of teaching the child to understand, but of teaching the child how to decode the sentences that *are to be understood.* (Engelmann, Haddox, & Bruner, 1983, p. 11)

This view from Engelmann and some of his collaborators supports the position that unidirectional practices are sufficient for reading comprehension. Becker (1977), however, who applied behavioral principles to the Direct Instruction Model that uses the Distar program, acknowledged that the model "did fall somewhat short of its goals to reach national norms in the comprehension area" (p. 540); and applications of Direct Instruction have found a need for additional activities with texts, beyond decoding, to develop comprehension (see Gersten & Carnine, 1986).

Research Evidence

At first, a casual inspection of the research in favor of phonics instruction may appear to support the unidirectional theory. However, the main issue in the research on phonics is not whether instruction in phonics alone is sufficient for developing reading skills, but whether children benefit from having more or less instruction in phonics and how much instruction they should have in other areas (cf. Adams,

1990; Carbo, 1988; Chall, 1989). In itself, instruction for assuring that children acquire phonics skills would be consistent with both unidirectional and multidirectional theories.

THE MULTIDIRECTIONAL THEORY

Although the unidirectional theory has a long tradition, there are serious problems with its assumptions (cf. Harris, 1986; Olson, Torrance, & Hildyard, 1985; Kolers, 1985; Moran, 1987; Smith, 1973; Street, 1984; Stubbs, 1980). The theory, for example, implies that writing did not exist until the alphabet was invented to permit speech to be written down. Unless writing is arbitrarily defined so narrowly that only alphabetic writing counts as writing, such an origin is purely fanciful. Fairly sophisticated writing systems date from around 3000 B.C, long before the alphabet was invented around 1000 B.C., and some writing (e.g., Chinese) has never become alphabetic (cf. Gelb, 1963; Harris, 1986). The theory also implies that spoken language must necessarily be learned before written language, but this is patently contradicted by deaf-mutes who acquire written language without acquiring speech and by those who learn to read and write a foreign language without being able to speak or understand the spoken language. In addition, the unidirectional theory implies that all the important distinctions in writing are derived from direct correspondences to distinctions in speech. This assumption can be refuted by showing the many important differences between spoken and written language. Research on writing, for instance, including the historical development of writing and the development of literacy in young children, has increasingly indicated more differences between speech and writing, more varied influences on the development of literacy, and more influences from writing on speech than the unidirectional theory suggests (e.g., Clanchy, 1979; Ehri & Wilce, 1986; Havelock, 1986; Householder, 1971; Olson, Torrance, & Hildyard, 1985; Ong, 1982; Stubbs, 1980).

In as much as many of the specific differences between speech and writing have only recently been brought out in the literature, the following will pursue these and other distinctions in some detail. This detail will serve to indicate the extent of the differences between speech and writing (for the similarities, see Skinner, 1957, pp. 185-226). These differences are found in the historical background or origins of speech and writing; in the contexts in which they occur as well as their use as contexts; in their organization; and in their consequences as well as their use as consequences.

Origins. The origins of speech appear to lie in gestures and vocal sounds (cf. Hewes, 1973; Wells, 1987). Gestures often compel immediate social adjustments. A society would have difficulty surviving if it did not respond to threatening gestures. Gestural communication could also become fairly well developed. The beginning movements in an action may be reinforced when these movements are responded to by an observer who completes the action or otherwise satisfies whoever initiated the action. Imitating the incomplete action with gestures on similar occasions would further this development, and conventionalized gestures could have been shaped over time in a community that benefitted from this communication.

Virtually any vocal sound would have some advantage in calling attention to a gesture, whether as a collateral side effect, as a sound developed from a previous call system, or in imitation of sounds made by an animal. Any differentiation of attention-getting sounds would have some value in speeding and clarifying communication when members of the community are not directly facing one another; when their view is impeded by obstacles, distance, or dim light; or when their hands are occupied. These and other advantages would further the development of vocal communication (cf. Hewes, 1973).

By contrast, writing appears to have developed from record keeping practices that integrated counting and pictorial representations (Friberg, 1984; Ifrah, 1987; Jasim & Oates, 1986; Schmandt-Besserat, 1978). Pebbles for counting seem to have

evolved into tokens of different shapes for a more differentiated accounting. Some of these tokens resemble the containers of the quantities represented; and some tokens were later impressed on clay tablets, thereby creating abstract graphic symbols for different objects and the number of them. Subsequently, a stylus was used to form these and other impressions. Pictographs often appear with these numerical signs; for example, to show the animal that has been counted or which person gets a particular quantity of rations.

Many realistic drawings gradually underwent a process of increasing abstraction that permitted commercial transactions, historical events, and codes of conduct to be recorded with less effort. The first abstractions need not have been great. A part may stand for the whole, and a pictograph of the head of an animal may represent the whole animal. Over time, the evolution of further abstractions and stylized representations has left us with forms for words (Chinese logograms) and letters (the alphabet) whose pictorial origins are no longer evident.

Contexts. Speech is for an immediate context. In a typical conversational exchange, the environment in which speech is listened to is the same environment in which it is produced. That immediate environment is continually brought into play in the support of speech, and speech is continually brought into play in the support of actions in the immediate environment. When additional environmental support for speech is needed, the speaker can often point to what is being talked about. In turn, the listener can ask questions, look puzzled, or make replies that indicate additional help is needed from the speaker. Those engaged in conversation can make rapid adjustments, and speech need not have detailed organization to do this. Various intonations of "Oh" or "Yeah" may be all that is needed to maintain participation in some conversations. An audio tape may preserve speech in a more apt analogy than writing to "frozen speech," but such tapes omit much, if not all, of the influencing context.

By contrast, writing is for remote contexts. The environment in which the writing is to be read is separate from the environment in which the writing is produced (see Nystrand, 1987). Even writing a note to someone across the room involves more separation between production and use than speech. With exceptions such as labels attached to the objects they name, this separation commonly places a burden on writing to construct a context for itself which is unnecessary in speech.

Such contexts of writing may be simple or complex. A geometric diagram provides a simple context for discovering something new. If we know two of the angles of a triangle, we can discover the third angle. According to Peirce (1960-61, 3.418-3.419), diagrams may also be constructed with algebraic symbols or words (e.g., a syllogism). If we consider diagrams as a construction of events with conditional relationships between them, Peirce's concept of diagrams would include Sidman's (1986) equivalence relationships and the four-term contingency that Sidman presents as the fundamental unit of contextual control. A striking characteristic of Sidman's equivalence relationships is their usefulness in accounting for the emergence of novel behavior. Similarly, Peirce (1960-61, 2.79) holds that a distinguishing property of diagrams and other icons (images and metaphors) is their capacity for revealing unexpected truth. Although verbal diagrams may also be constructed orally, we can see the advantage of writing when diagrams become complex. Relationships can be discovered and demonstrated that might not otherwise have been noticed. Writing allows geometrical and syllogistic reasoning and the unexpectedly valid truths of logic and mathematics to develop further than they could in a strictly oral culture. Exposures to complex, diverse texts may also support novel behavior. Coleridge, for example, apparently composed some of his poems like the Rime of the Ancient Mariner and Kubla Khan in response to multiple texts (Goldiamond, 1977).

Organization. Each segment of speech

provides a point of departure for the next segment, and different parts of the sequence that are not immediately connected may show little direct relationship to one another unless some conspicuous pattern has been imposed. Halliday (1987) has described this serial flow metaphorically: "The complexity of spoken language is choreographic" (p. 66).

To facilitate accurate recall, oral accounts commonly include mnemonic devices like repetition of patterns and sounds; for example, the golden rule, "Do unto others as you would have others do unto you" or the maxim, "Early to bed and early to rise makes a man healthy, wealthy and wise." Longer oral accounts typically incorporate narrative formulas that facilitate remarkable feats of memory (cf. Yates, 1966). In spite of these aids, oral accounts are continually susceptible to changes induced by new contexts for their delivery. Even oral traditions that emphasize accuracy will show some striking shifts when a new context supports that shift (Goody & Watt, 1968).

As an illustration of the difficulty in preserving an oral message without corruption, children sometimes play a party game, "Pass It Along," in which one child whispers a message to the next child who similarly passes it along. After the message has gone around, the last child to hear the message says it aloud and so does the first child who delivered the message. The final message usually turns out to be distorted in ways that children find amusing if not hilarious.

In contrast to speech, writing can include precisely accurate details that may be reliably built upon in presenting further expositions. Such accuracy is possible because writing can be repeatedly revised and checked before it is put forth as an accurate model, and afterwards the written model can be repeatedly reexamined in order to follow it accurately. Exact replicas of the same text may be placed in the hands of many readers for exact comparison with other texts as well as with the physical events described. This allows a steadily increasing clarity and precision about events referred to in writing that speech cannot approach. In the case of chemical and mathematical formulations, speech may not even make the attempt. The fact that a scientific revolution followed the invention of the printing press, which considerably enhanced the advantages of writing in this respect, is probably more than a coincidence (see Eisenstein, 1983).

The organizational detail and clarity of writing is aided by a variety of features with no direct correspondence in speech: headings and subheadings to identify topics and the relationship between topics; graduated spacing between letters, words, sentences, paragraphs, and chapters to indicate smaller and larger units of text; punctuation to show relationships between these units; capitalization, underlining, italics, and bold print to indicate a special meaning to be attached to words (e.g., the reference is to a published book, a foreign word, or a specially defined term); and different sizes of print to indicate topical organization, the more embracing topic with the larger print, the subtopic in smaller print. No exact correspondence to these organizational features exists in normal conversation. A pause in conversation, for example, is not the equivalent of a space that identifies units or punctuation that identifies relationships between units. Pauses in speech occur when a speaker is considering how to compose further speech, is creating a dramatic effect, is waiting for a reaction, is interrupted, or is out of breath.

In addition, writing shows some important similarities and differences between words to a greater extent than speech does. In indicating a semantic similarity between words, the different spellings of words like *marine/mariner* and *sign/signify* retain a similarity in form more than they retain a similarity in sound. In indicating semantic and grammatical distinctions between words, writing makes much more use of different spellings for words that sound the same (homophones, e.g., *rose, rows, roes, row's,* and *roe's*) than speech does of different pronunciations for words that are

spelled the same (homographs, e.g., /red/ and/reed/for *read*) (cf. Stubbs, 1980, p. 34).

With the aid of organizational features like the above, more items and relationships among items can be packed into writing. Writing has a higher lexical density than speech and proportionately more content words, more nominalizations, and more metaphorical contexts (Halliday, 1987). In addition, writing tends to pursue integrated relationships among all of its component parts. Halliday (1987) has described this metaphorically: "The complexity of written language is crystalline" (p. 66).

Consequences. When we consider that the listener can respond to speech as soon as it is produced, it is apparent that consequences may occur quite rapidly in cycles of vocal exchanges that may be shaped toward unforeseen ends. This may partially explain why speech is easy to acquire without formal instruction. To assist these interactive cycles, speech incorporates signals like "Well" at the beginning of speech, to indicate that the turn-taking has continued relevance. Such a function is of little use in writing other than to simulate speech.

By contrast, since writing is for use in another context, the most significant consequences for writing are characteristically delayed. This is a disadvantage in learning to write, but an advantage in extending effective action to remote environments. Since the written record can endure for examination in a variety of other environments, plenty of opportunity exists for additional responses to those records; and these extended consequences of the original writing can be delivered after careful deliberation of the record. Further records, and further consequences, may be based on these records with little loss of accuracy no matter how long the time delay between the original record and the records based upon it.

Brief textual records based on earlier records include certificates, licenses, diplomas, permits, and passports. Longer textual records based on earlier records typically include any type of published research, whether in a scientific report or a historical account. One particularly useful record, which may be based on previously collected data, is a diagrammatic graph of frequency counts. These diagrams have the advantage of showing selected relationships and changes in relationships in a conspicuous manner. Nothing comparable to such graphs exists in oral language.

Educational Implications

In as much as many features of writing have no direct correspondence in speech, children may particularly need to become responsive to these features if literacy is to develop. Instruction that relies simply on having students formally *match* speaking and writing will not address many of the relationships peculiar to literacy. Some children may learn many of these relationships on their own, but some may not. *Composing* a response to multiple, diverse influences in comprehending or writing a text may be particularly difficult. To develop these other relationships, a multidirectional approach would support a print environment, reading a variety of texts, being read to from a variety of texts, frequent early writing and reading of that writing, and student record keeping. Activities for matching speaking and writing would also be supported, but not as an exclusive focus. Although some of these features may be found in existing literacy programs, they are not comprehensively implemented in any one literacy program currently being advocated.

A print environment. Print environments for one word responses (e.g., a sentence with a word replaced by an underlined space) can be found in the cloze exercises of reading, the test frames of linguistics, and the response frames of programmed instruction. Print environments for more extensive responses occur in "story grammar" frames (Cudd & Roberts, 1986; Lehr, 1987) and some computer programs (Hummel, 1985; Johnston, 1985). Johnston, for example, presented a favorable review of TRAY, an elaborate extension of the popular "hangman" spelling game. Students, individually or in groups, re-cre-

ate a text held in the computer. The text may be displayed with dashes for each missing letter and with punctuation or with punctuation only and no information about word-length or boundaries. The students predict letters, letter groups, words or longer units. Alternatively, letters may be "bought" from the computer, which fills them in within the text. Predicting scores points, buying loses them. Johnston commended this program for the wide range of language skills that can be brought to bear in playing it.

In addition, a comprehensive literate environment for young children has been recommended for supporting a variety of responses to print (Morrow & Weinstein, 1982; Taylor, Blum, & Logsdon, 1986). Such an environment would include a variety of books (e.g., commercial, authored by an individual child, authored by a group of children), communications (e.g., child and teacher authored notes, messages, and letters), lists (e.g., check lists of activities completed, references like alphabet charts), directions (e.g., classroom rules, directions for activity centers), schedules (e.g., daily activity schedule, job schedule), labels (e.g., location of centers, contents of shelves, captioned art work), and a variety of materials for writing (e.g., paper, chalkboard, flannel board, pens, pencils, markers, crayons, chalk, staples, glue, scissors, stencils, dittos, plastic letters, and transparent plastic overlays).

A variety of texts. In responding to a variety of texts, children have further access to the ways in which writing differs from speaking. Children may be given earlier exposure to expository prose and written directions instead of the almost exclusive reliance on narrative or fictional writing that many children are now presented with (Stotsky, 1987). Reading and following directions (e.g., at stations, in a cooking recipe, or a science activity) would seem particularly beneficial to young children since there could be such conspicuous consequences for doing this. In addition, children might be assessed more often on their ability to use texts in different ways, as in open book tests. Somewhat ironically, children are typically assessed on their ability to spell words from dictation without access to the dictionaries that the adult normally has access to but may not have learned how to use.

Frequent writing. Daily writing, such as Graves (1985) recommends for a process approach to writing, can be done in every grade. Typewriter and microcomputer keyboards can circumvent the difficulties that young children have with handwriting. Keyboards may also have an advantage in developing standardized spelling (see Moxley & Joyce, 1990). Most environmental print resembles the writing children can produce with keyboards rather than the writing they can produce with pen or pencil. This should make it easier for children to see when the words they have spelled are the same as the words they have read, which should make it easier to determine when a spelling needs to be revised.

Student record keeping. Children can also acquire literacy skills in labeling charts, in connecting concrete events to the abstract marks on a graph, and in interpreting the meaning of these records. Children are commonly asked to read and interpret a graph on a standardized test, but they may never have been asked to produce one in the classroom. In as much as record-keeping lies at the historical origins of writing, it may be worthwhile to see what record-keeping offers for emergent literacy in young children. Although this area has generally been neglected by advocates of literacy programs, it is one that would seem particularly appropriate for development by a behavioral technology.

Research Evidence

Research on the development of literacy in children shows more than just the influence of speech. Stotsky (1987) even found that the evidence for literacy skills being improved by other activities in literacy is stronger than the evidence for literacy skills being improved by activities in speech. Writing activities can improve comprehension, for example, and "Reading experience seems to be a consis-

tent correlate of, or influence on, writing ability" (Stotsky, 1983, p. 637). In particular, the growing studies on emergent literacy contradict the notion that literacy development simply waits upon the development of speech.

As Sulzby (1986) put it, "Current research in young children's writing and reading development suggests that it is erroneous to think that children in literate societies acquire writing and reading as 'written language' after they have acquired 'oral language'" (p. 50). For example, consider early reading to a child, which has been recommended for furthering later reading development (Anderson, Hiebart, Scott, & Wilkinson, 1985). Any benefits to the child from listening to oral reading are clearly dependent on the prior influence of the printed word. In responding to a text being read aloud, children are not responding to spontaneous oral language, they are responding to the structure of writing as represented in speech (i.e., speech as writing spoken aloud).

In addition, some children obviously learn to read without formal decoding instruction. Studies of children who are early readers before coming to school show no evidence of learning to read from a particular method of reading instruction such as a phonics approach (Durkin, 1966; Price, 1976; Torrey, 1973). Furthermore, even a normal hearing child may acquire reading skills before speaking (Steinberg & Steinberg, 1975).

BEHAVIOR ANALYSIS

Currently, behavioral approaches to literacy are widely interpreted as the mechanistic product of an S-R psychology (cf. Otto, 1982; Schweinhart, Weikart, & Larner, 1986; Smith, 1989); and the unidirectional approach is fairly readily interpreted as being consistent with S-R theory. The similarity—in which an antecedent event (S or speech) directly produces an effect (R or writing)—is a conspicuous one. This may encourage the assumption among those who believe modern behavior analysis is an S-R psychology that behavioral approaches support the unidirectional theory.

Even among early behaviorists, however, the evidence for such an assumption is largely indirect. For example, influenced by the behaviorist Albert Paul Weiss (1879-1931), Bloomfield altered his earlier approach to language into one that was more in conformity with the principles of S-R psychology (Esper, 1968; Harris, 1980; Hymes & Fought, 1981; Kantor, 1977; Powell & Still, 1979; Tweney, 1979). Bloomfield (1933) also claimed, "Writing is not language, but merely a way of recording language by means of visible marks" (p. 21). Bloomfield's (1942) views on reading instruction were later incorporated in *Let's Read: A Linguistic Approach* (Bloomfield & Barnhart, 1961) which also emphasized a derivative role for writing. Although behavioral psychology became closely identified with Bloomfieldian structuralist methods in linguistics and the assumption that written language was dependent on spoken language (see Stubbs, 1986, p. 222), the closeness of Bloomfield's relationship with behavioral psychology, is questionable (see Julia, 1983).

The identification of behavioral views with unidirectional views may also be partially due to the fact that early behavioral accounts of language paid relatively little attention to writing as distinct from speech. When Watson (1930) asked, "What is language?" (p. 225), his answer was in terms of vocal behavior. Watson's only reference to writing in that passage occurred in a brief example of reading aloud.

In addition, in his behavioral account of grammar, Kantor (1936) described letter writing as an extension of speech:

> Writing is at best formalized action, which requires a pen or pencil in addition to the person's own anatomical mechanism. And yet despite its extreme artificiality it is still genuine and even animated speech. The activity in this case is merely an extension of the activity of speaking over a wire. (p. 28)

This is a fairly strong expression—similar to Bloomfield's—of a derivative role for writing. Kantor's (1977) later comments on writing appear to protect this position: for

example, "When persons learn to write, they fixate their own speech actions by recording them" (p. 136). Interestingly, Kantor's views are commonly considered to reflect a contextual orientation opposed to S-R psychology.

Furthermore, some behavior analysts have emphasized correspondences between speech and writing in discussing reading—sometimes with a qualified commendation of Bloomfield's approach (Holland, 1979), sometimes with a pronounced S-R analysis (Staats, 1968). Attending to speech and addressing correspondences between speech and writing, however, does not by itself necessarily entail support for unidirectional theory. Nor does it contradict such support. Such correspondences would be appropriately discussed from multidirectional as well as unidirectional views.

Claiming unqualified behavioral support for unidirectional theory may also appear to be consistent with behavior analytic support of the Direct Instruction Model in which the Distar program is used. As we have seen (Engelmann et al., 1983, p. 11), Engelmann, who has been intimately involved with that program, has advocated a unidirectional view; and the Direct Instruction Model has been advanced as a behavioral technology by some behavior analysts (e.g., Pennypacker, 1986) and explicitly linked to Skinner's psychological theory (Schweinhart, Weikart, & Larner, 1986). However, a distinction should be made between behavioral contributions to applications of a theory and behavioral contributions to the theory itself. For example, Bereiter (1986), who co-founded the direct instruction preschool program with Engelmann, maintained their program was based on "a rationalist program of concept teaching not even remotely Skinnerian in theory" (p. 290).

Finally, Skinner (1989) has made some passing comments, which might be interpreted as offering support for a derivative interpretation of writing. His allusion that "if architecture is frozen music, then books are frozen verbal behavior" (p. 44) may be interpreted as in harmony with unidirectional theorists who refer to writing as frozen speech. In addition, his statement that "The alphabet seems to have come into use to keep records when goods were exchanged" (1989, p. 87) may be taken to imply that written records were not kept for that purpose long before the invention of the alphabet, which invites the assumption that writing was derived from speech with the invention of the alphabet. However, for Skinner, verbal behavior is not the equivalent of speech and his comment on the origin of the alphabet does not logically exclude the previous existence of written records.

Although the above, largely circumstantial evidence for behavioral support of unidirectional theory may appear convincing, it does not hold up well in the face of Skinner's views on verbal behavior. In contrast to unidirectional views, Skinner (1957) maintained that speaking and writing are different behaviors that are learned in different ways: "But speaking and writing are obviously different kinds of behavior, which utilize different parts of the body in different ways . . . .The two forms of behavior must be separately conditioned" (p. 191). Further, Skinner (1957) explicitly rejected the notion that writing is merely a representation of speech, pointing out instances in which writing is established apart from speech.

> Sometimes it seems to be implied that the spoken form is the word and that the written response is merely a way of representing it. This simply makes the transcriptive process unilateral. But we have no reason to assume that there is any basic medium of verbal behavior. One form of response is likely to be learned first by a given speaker and may remain so strong that it occurs first upon any given occasion, but written English, for example, is established apart from any vocal language in deaf-mutes, and could continue as a full-fledged language in its own right in a community of deaf-mutes. Even where there is a vocal parallel, it is often evident that parts of a written repertoire are still primordial. Separate speaking and writing vocabularies are the rule rather than the exception. (p. 192; also see p. 14)

Skinner (1957) also discussed some important distinctions in writing that are not found in speech (e.g., self-editing, pp. 369-402). In addition, Skinner (1972, pp. 177-178) indicated an indefinite variety of

influences on the development of reading and was obviously opposed to the idea that children acquire "an ability to read" when they learn to convert print into speech.

Skinner's overall discussion of verbal behavior lends itself to the following brief definitions which may help to clarify his position. Speaking is vocal verbal behavior or verbal behavior that occurs by means of sounds. Writing is graphic verbal behavior or verbal behavior that occurs by means of markings. Listening is any response under at least the partial control of speaking, and reading is any response under at least the partial control of writing. Although all of this implies some parallels between speaking, writing, listening, and reading—they all involve verbal behavior—none of this implies that writing is necessarily dependent upon speech or that literacy is necessarily dependent upon orality.

Skinner did not expand upon his position toward writing, however, in the detail that he might have. For example, in developing a terminology of verbal behavior that cut across different modes of expression, Skinner (1957) focused on vocal verbal behavior "as representative" (p. 14) of verbal behavior in general and defined "textual behavior" in vocal terms (p. 66). The choice of the term *textual behavior* to refer only to what is commonly described as reading aloud was unfortunate to the extent that it may give the impression that reading aloud is the only response to a text to be considered. In Skinner's (1957) definition of a text, vocal relationships are also prominent:

> A text may be in the form of pictures (in so far as the response consists simply of emitting an appropriate vocal form for each picture), formalized pictographs, hieroglyphs, characters, or the letters or symbols of a phonetic alphabet (regardless of the accuracy or consistency with which the alphabet records vocal speech). . . . A speaker under the control of a text is, of course, a reader. (p. 65)

In spite of this use of only vocal examples to illustrate responses to a text, all responses to a text are obviously not vocal (e.g., as when we walk out the door under which we read the word *Exit*); and it is obvious that Skinner is aware of these different responses (especially see Skinner, 1972). Nevertheless, Skinner (1957) chose to use *textual* in a narrow sense: "In a textual operant, then, a vocal response is under the control of a nonauditory verbal stimulus" (p. 66). Skinner's preoccupation with vocal behavior here was followed by his discussion of "transcription—either in the copying of written material or in taking dictation" (p. 71). This presentation of transcription may also appear to be part of an exposition that makes writing dependent upon vocal behavior. Skinner makes it clear in this section, however, that "written behavior" embraces more than copying or writing from dictation (e.g., composing and editing are specifically mentioned) and that transcription does not embrace all that is meant by writing.

Far from representing all that is meant by writing, transcription belongs to a subset of verbal behavior under the control of one-to-one correspondences, which may be described as *matching* behavior (see Moxley, 1986):

> In echoic behavior and in writing from copy there is a formal correspondence between stimulus and response-product. In textual behavior and in taking dictation there is a point-to-point correspondence between different dimensional systems. But some verbal responses show no point-to-point correspondence with the verbal stimuli which evoke them. (Skinner, 1957, p. 71)

One example of a response lacking point-to-point correspondence is an *intraverbal* response under the control of contiguous verbal stimuli. In fact, for Skinner (1957), most verbal behavior is under multiple control from various contextual sources (see pp. 227-228). Although Skinner presents different categories of verbal behavior under different sources of control, this should not be interpreted to mean one category exists in isolation from another category. Responses to multiple sources of control—or *compositional behavior* (see Moxley, 1986)—are the rule rather than the exception in verbal behavior.

Nor, as should now be apparent, should Skinner's focus on vocal behavior as representative of verbal behavior be interpreted as a commitment to a unidirectional influence from speech to writing rather than a

strategic approach to his exposition. Skinner's views on the differences between speech and writing went against the established linguistic position of that time. Attending to vocal behavior would presumably reduce attacks from those with a background in that position. Of course, this did not prevent attacks from Chomsky (e.g., 1957), who rejected "Bloomfield's behaviorism" (1965, p. 205) and the empiricism that it entailed (1965, pp. 51-52). Ironically, Chomsky's transformational-generative approach has now been discredited (1) as a rationalist analysis that was more mentalistic but not different in kind from the mechanistic logic of Bloomfield's structuralism, and (2) for failing to observe important differences between speech and writing (cf. Hymes & Fought, 1981; Julia, 1983; Street, 1984).

CONCLUSION

On balance, the arguments and evidence presented above favor the multidirectional theory and behavior analytic support of that theory. This support is clearer in contemporary behavior analysis than in early S-R psychology. The if-then simplicity of early S-R theory is no longer an ideal for all behavioral accounts, and any tendency to see the relationship between speech and writing as a simple one-way relationship receives little support now from dispositions toward a Mechanistic World View (which were fairly pervasive at the turn of the century). Instead of an exclusive reliance on paired correspondences between stimulus and response, modern accounts of behavior have largely shifted to a more systematic, functional analysis of behavior in terms of (1) functional antecedent correspondences to behavior, (2) functional consequences, and (3) the functional contexts of settings. Instead of a general description of behavior in terms of stimulus and response (S-R), behavior is now more appropriately described in terms of antecedents, behavior, consequences, and setting (AB-because-of-C in S).

The main practical issue to be resolved is which ways will be better ways of applying modern behavioral theory. Since the multidirectional view undermines any theoretical need for a priori one-way sequences of instruction, a variety of other ways might well be considered and implemented for developing literacy (cf. Moxley, 1982, 1986). Instruction, for example, might be continually modified by teachers on the basis of student self-recorded progress in a variety of literacy skills. Revising their instruction on the basis of reported data, inside and outside of their classroom, teachers might then pull together a variety of multidirectional practices in different ways from a variety of behavioral technologies. The resulting reading program may then appear as bits and pieces connected by unifying themes—a status which has been claimed for behavioral technology in general (Bailey, 1987). Such a collection of bits and pieces may be disconcerting to those who like tightly integrated end products. But such an arrangement may be an advantage if it encourages components to be changed and modified. Perhaps more progress in literacy would occur by selecting from competing components rather than competing total packages. Giving teachers more instructional discretion in doing this, however, will probably mean giving teachers more support in advancing record-keeping both as a fundamental literacy skill and as a method for evaluating instruction in literacy skills.

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